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TITLE

HEAT DISSIPATING APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a heat dissipating apparatus, and in particular to a heat dissipating apparatus that is easily disassembled from an electronic device.

Description of the Related Art

Generally speaking, a central processing unit, such as Intel Pentium 4 Northwood, employed in a desktop or portable computer is combined with an integrated heat spreader (IHS). The integrated heat spreader is composed of copper-based alloy to dissipate heat generated by the central processing unit.

Referring to FIG. 1, a central processing unit (CPU) 1 includes a substrate 11, multiple pins 12 and a silicon chip 13. The silicon chip 13 is disposed on the substrate 11, and the multiple pins 12 are disposed under the substrate 11. Additionally, an integrated heat spreader 2 is disposed on the substrate 11. The integrated heat spreader 2 has a recess (not shown) to receive the silicon chip 13

Referring to FIG. 2, when the CPU 1 having the integrated heat spreader 2 is inserted into a socket 3 of a computer main board by means of the pins 12 thereof, a heat sink 4 is also disposed on the integrated heat spreader 2 to dissipate heat generated by the CPU 1.

Nevertheless, since the contact surface between the integrated heat spreader 2 and heat sink 4 may be uneven, a gap (not shown) exists therebetween. Heat conduction between the integrated heat spreader 2 and heat sink 4 is adversely affected by the gap. A thin layer of thermal paste, such as a phase change material (PCM) 5, is disposed between the integrated heat spreader 2 and base 41 of the heat sink 4 to enhance the heat conduction therebetween. The phase change material 5 fills the gap between the integrated heat spreader 2 and base 41 of the heat sink 4 to increase the contact area therebetween, thereby enhancing the heat conduction between the integrated heat spreader 2 and heat sink 4.

The following description explains the characteristic of the phase change material 5. Because the melting point of the phase change material 5 is approximately 50 ^{0}C, the phase change material 5 is solid at room temperature. The phase change material 5 melts and becomes liquid when the ambient temperature exceeds 50 ^{0}C, thereby filling the gap between the integrated heat spreader 2 and base 41 of the heat sink 4. When the ambient temperature is below 50 ^{0}C again, the phase change material 5 becomes solid. Additionally, the phase change material 5 has low thermal resistance, such that the thermal conduction rate thereof is much higher than that of a conventional silicone rubber.

Accordingly, when the CPU 1 operates at high temperature (greater than 50 ^{0}C), the phase change material 5 melts and is attached to the integrated heat spreader 2 and base 41. When the CPU 1 cools, the phase

change material 5 solidifies, creating a strong adhesive bond between the integrated heat spreader 2 and the base 41. As a result, when the CPU 1 is replaced, the heat sink 4 and CPU 1 are sequentially disassembled from the socket 3. When the heat sink 4 is removed from the socket 3, the strong adhesive bond between the integrated heat spreader 2 and base 41 (the adhesive force between the integrated heat spreader 2 and base 41 greater than the clamping force between the socket 3 and pins 12 of the CPU 1) cause that the heat sink 4 and CPU 1 are simultaneously separated from the socket 3. At this point, the pins 12 of the CPU 1 are often bent or broken due to excessive or improper force, or an improper pulling direction, as shown in FIG. 3.

Moreover, to protect the pins 12 of the CPU 1 from damage due to excessive force or improper direction, the phase change material 5 can be heated to a temperature higher than the melting point thereof. Once the phase change material 5 melts, the CPU 1 (or integrated heat spreader 2) can be easily separated from the heat sink 4. Heating the phase change material 5, however, is time-consuming.

Hence, there is a need to provide an improved heat dissipating apparatus to overcome the aforementioned problems. The present heat dissipating apparatus has a simplified structure and is easily separated from a CPU, considerably reducing disassembly time and potential damage thereto.

SUMMARY OF THE INVENTION

Accordingly, an object of the invention is to provide a heat dissipating apparatus for an electronic device having an integrated heat spreader. The heat dissipating apparatus comprises a base having a lower surface and an upper surface. The lower surface has a contact area to contact the integrated heat spreader when the base is disposed on the electronic device. The lower surface has a concave area extended to the contact area from the edge of the base.

Preferably, the contact area of the base is connected to the integrated heat spreader by means of thermal paste.

Preferably, the thermal paste is composed of a phase change material.

Preferably, the base further comprises a plurality of fins formed on the upper surface thereof.

Preferably, the cross section of the concave area is rectangular, semicircular or triangular.

Preferably, the integrated heat spreader and contact area are substantially rectangular.

Preferably, the electronic device is a central processing unit (CPU).

A detailed description is given in the following embodiments with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention can be more fully understood by reading the subsequent detailed description and

examples with references made to the accompanying drawings, wherein:

FIG. 1 is a schematic perspective view showing an integrated heat spreader disposed on a central processing unit;

FIG. 2 is a schematic side view showing a conventional heat sink and the central processing unit inserted into a socket;

FIG. 3 is a schematic side view showing the conventional heat sink and central processing unit separated from the socket according to FIG. 2;

FIG. 4A is a schematic side view showing the heat dissipating apparatus of the invention;

FIG. 4B is a schematic bottom view according to FIG. 4A;

FIG. 5 is a schematic side view showing the present heat dissipating apparatus and a central processing unit inserted into a socket;

FIG. 6 is a schematic perspective view showing a slotted screwdriver inserted into the heat dissipating apparatus of the invention; and

FIG. 7 is a schematic perspective view showing the present heat dissipating apparatus separated from the central processing unit by means of the slotted screwdriver.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 4A and FIG. 4B, the heat dissipating apparatus 100 includes a base 110 and a plurality of fins 120. The fins 120 are uniformly formed

on the base 110 to dissipate heat. Additionally, a concave area 111 and a contact area 112 are formed on the lower surface of the base 110. As shown in FIG. 4A, the cross section of the concave area 111 is rectangular. As shown in FIG. 4B, the concave area 111 extends into the contact area 112 from the edge of the lower surface of the base 110. The plurality of fins 120 are formed on the upper surface of the base 110.

Referring to FIG. 5, the heat dissipating apparatus 100 is applicable to an electronic device 1 having an integrated heat spreader 2 to perform thermal conduction and heat dissipation. The electronic device 1 may be a central processing unit packaged by means of an FCPGA method. The central processing unit (CPU) 1 includes a substrate 11, a plurality of pins 12 and a silicon chip (not shown). The integrated heat spreader 2 is disposed on the substrate 11 of the CPU 1.

As shown in FIG. 5, the CPU 1 is inserted into a socket 3. When the heat dissipating apparatus 100 is disposed on the CPU 1, the base 110 of the heat dissipating apparatus 100 contacts the integrated heat spreader 2 disposed on the CPU 1. Specifically, the integrated heat spreader 2 is connected to the contact area 112 shown in FIG. 4B, on the lower surface of the base 110. Additionally, thermal paste, such as a phase change material (PCM) 5, is disposed between the contact area 112 and integrated heat spreader 2 to fill the gap therebetween. Thus, the surface contact area between the contact area 112 and integrated heat spreader 2 is increased, and the thermal conduction therebetween is

enhanced. Specifically, the position of the contact area 112 of the base 110 corresponds to that of the integrated heat spreader 2. Furthermore, the shape of the contact area 112 may be the same as that of the integrated heat spreader 2 and substantially rectangular.

Similarly, when the CPU 1 operates, the phase change material 5 melts due to the high temperature thereof and is attached to the integrated heat spreader 2 and base 110. When the CPU 1 cools, the phase change material 5 becomes solid again and creates a strong adhesive bond between the integrated heat spreader 2 and base 110. At this time, the heat dissipating apparatus 100 can be simply separated from the integrated heat spreader 2 by means of a slotted screwdriver. Specifically, as shown in FIG. 4B and FIG. 6, the flat end 61 of a slotted screwdriver 6 is inserted into the contact area 112 via the concave area 111 of the base 110. As shown in FIG. 4B and FIG. 7, the slotted screwdriver 6 is then rotated about 90 degrees inside the contact area 112 and the integrated heat spreader 2 is easily separated from the base 110. Further, the CPU 1 and integrated heat spreader 2 can be directly disassembled from the socket 3 without damaging the pins 12 of the CPU 1.

Accordingly, since the structure of the substrate 11 of the CPU 1 is fragile, the concave area 111 of the base 110 is extended to the contact area 112 to prevent the slotted screwdriver 6 from exerting force on the substrate 11 of the CPU 1. Thus, the substrate 11 does not break and the circuits therein are not damaged. In another aspect, the integrated heat spreader 2 is

composed of copper-based alloy, such that the integrated heat spreader 2 is more resistant to force.

Moreover, the cross section of the concave area 111 of the base 110 is not limited to a rectangular shape. The cross section of the concave area 111 may be semicircular or triangular as long as a slotted screwdriver or similar tool can be inserted into the concave area 111 and rotated therein.

While the invention has been described by way of example and in terms of the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.